Building
Android Dental Camera System

Android Builders Summit 2014

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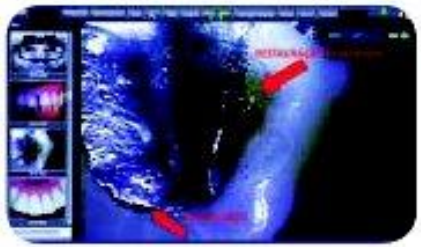
Agenda

- Scenario
- Motivation
- Project requirements
- Challenges and solutions
- Final solution
- Summary
- Q&A

Scenario

Existing system

- Customized Ubuntu
- Dental Software
  - Electronic health records of patients
  - Storing digital dental pictures
  - Simple image editing of the dental pictures
- Some entertainment software included



Scenario

Hardware

- Digital Camera
- All in one with Intel Atom N455 (x86)
- User Interaction using Air mouse
- Multiple USB peripherals
  - Foot pedals (for camera activation)
    - Mouse inside a box
  - Multiple Pendrive Storage support

Performance Issues

Action	Time to execute
Boot	56s
Save picture	6s
View a Picture	2s
Start image capture	5s

Motivation

- Software evolution limitations
- Needed performance improvements
- User interface needed to improve
- Got governmental funding to finance the product upgrade

Project

Migrate the operating system to Android

- Easy of use
  - UI similar to what dentists owners of Android devices already have
- Easy to find skills for new softwares
- Easy to find new softwares to integrate

Modernize the foot pedal activation device

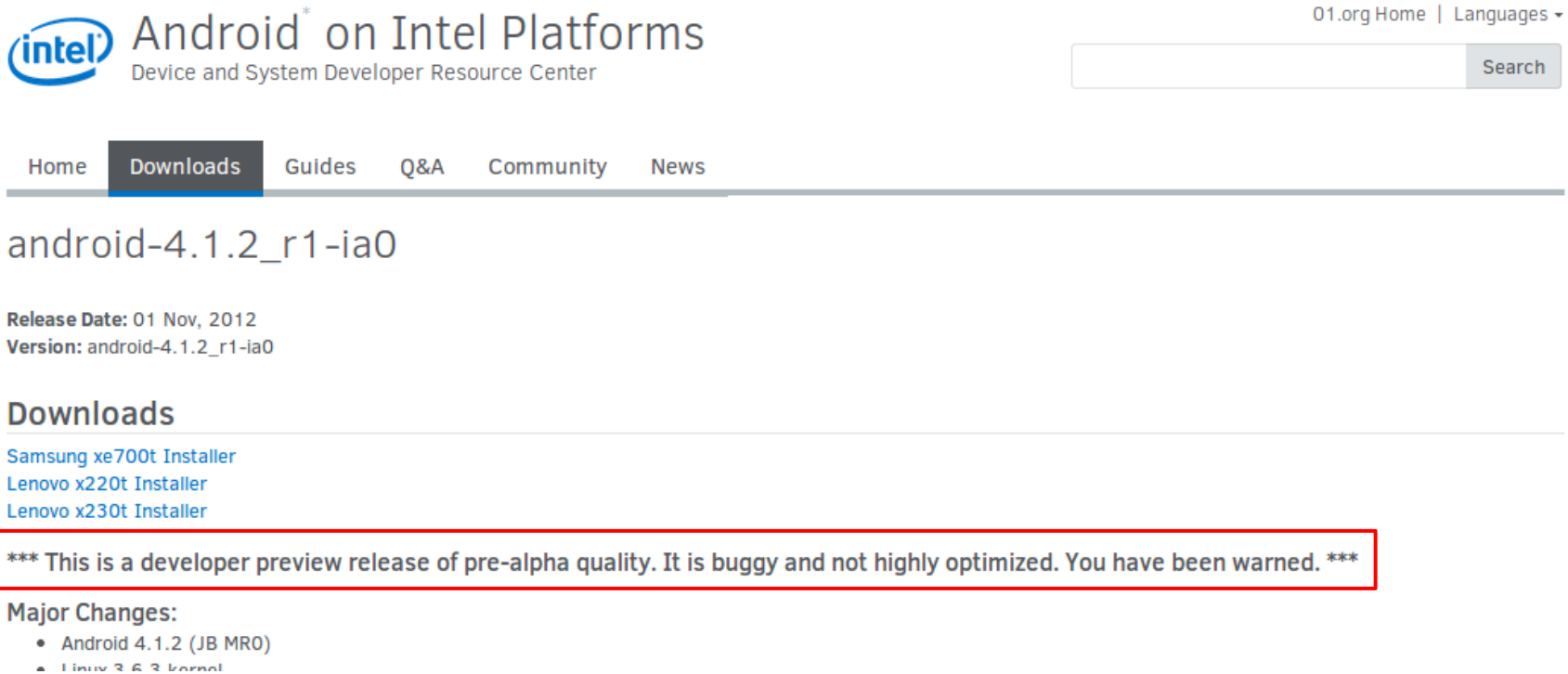
- To reduce power consumption

Selected Android ‘distribution’

Needed a stable and complete x86 Android distribution

April 1st 2014 Intel provided an Android Code for Intel Architectures.

Selected Android ‘distribution’



Selected Android ‘distribution’

Decided to use Android-x86

- Started in 2009
- Supports Atom N455
- Very active group
- Pretty open
- ICS 4.0.3

Challenges

Identify the most compatible target device configuration

- EeePC
  - Wifi works fine
  - Power button

Video with Hardware Acceleration

Live Demo worked at first try. Problems solved?

- Video card needed i915 driver
  - Default menuconfig had not this driver selected
- Simply activated it

Video Capture Support

- SAA7113
  - Worked smoothly at first
- However Android by default uses only the internal PCI camera
- Configure USB cameras
  - Hard way - Investigating CameraFactory.cpp
    - Create /etc/camera.cfg
      - Format: ORIENTATION DEVICE
- Added support to multiple cameras

Video Capture Support 2

Needed to have camera settings

- Brightness / Contrast / Saturation…
- Support in V4l2 but no support in Android's Libcamera implementation

Added some custom methods to v4l2camera.cpp and in CameraHardware.cpp

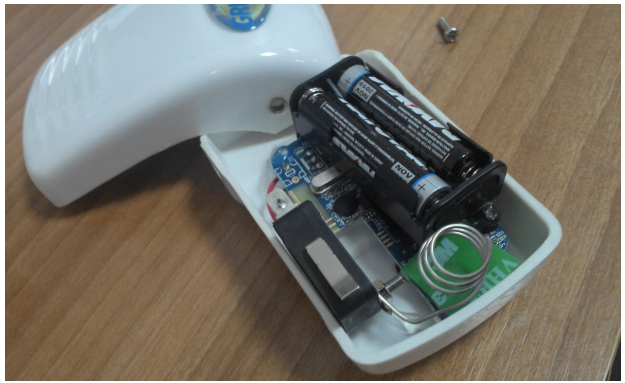
It also helped with the requirement of setting video norm (NTSC/PAL...)

Challenges

- Multiple USB storage
  - ICS only supports 1 USB mounted
  - JB has support to multiple USBs
  - Migrate from Android 4.1 -> 4.0.3
  - Mainly code from system/vold
  - USB1 / USB2 / USB3 ...

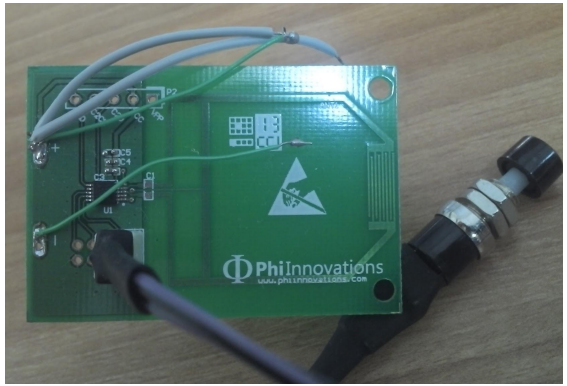
Challenges

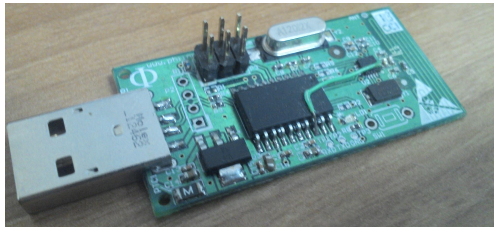
- Existing foot pedal
  - Actually a wireless mouse inside a box
- Consumes too much battery
  - Motion ~20mA
  - Quick Idle 1.3mA
  - Long idle 0.29mA



Challenges

- New foot pedal solution
  - Using a Silicon Labs Si4010 that only sends 10 radio comm per press
    - Idle it consumes < 10 nA ($10x10^{-6}$mA)
    - Activated it consumes 10 mA during 3 seconds
  - Receiver using Si 4355 and uC Freescale to communicate with USB
  - Android native code receives the connection and broadcasts the event for the apps





Challenges

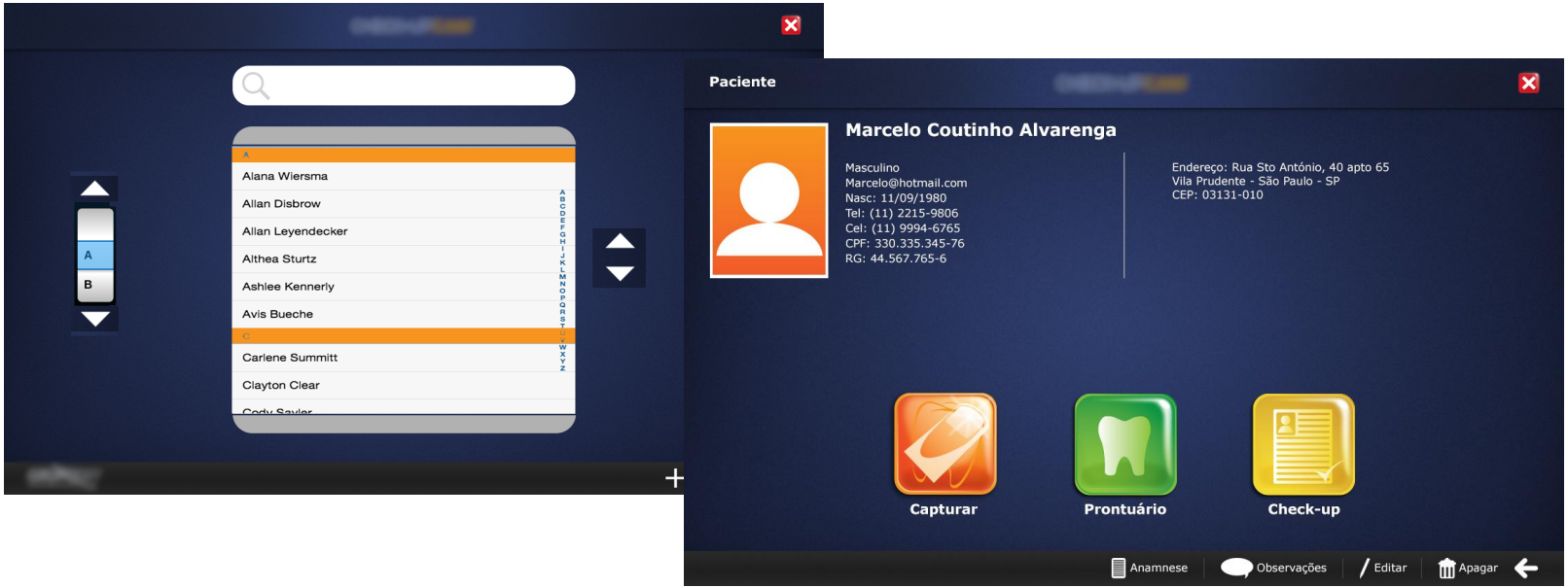
- Support printers
  - Printer drivers on Android is really limited
- SkyPrinter Service
  - Custom network service on a Windows or Mac computer

Application Layer

- Home Application UI
  - Easier the access to main system features
- Access to Android standard components

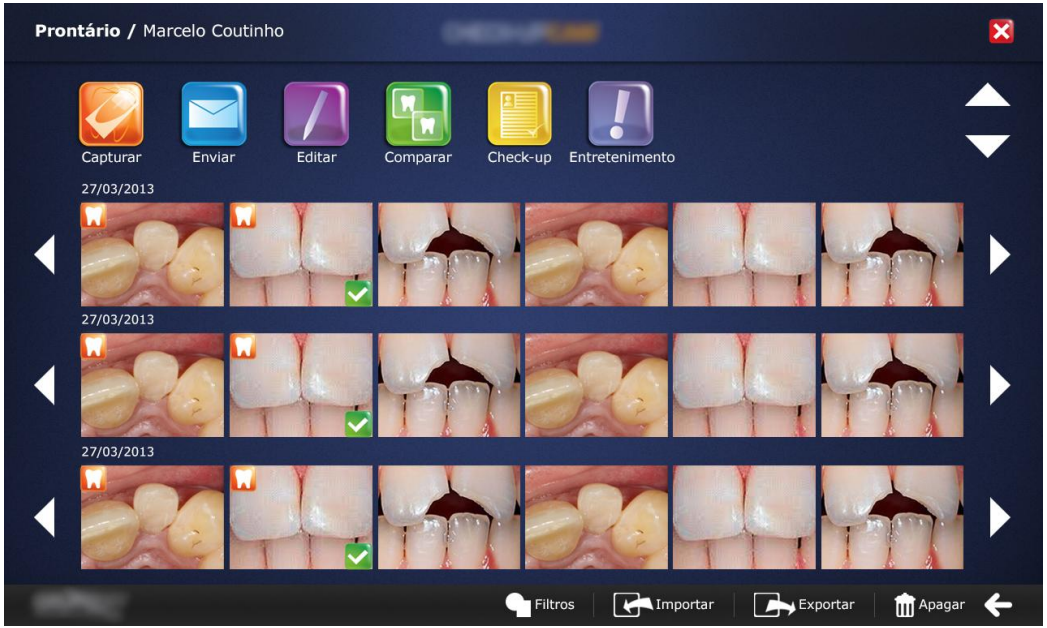
Application Layer

Electronic health records of the patients



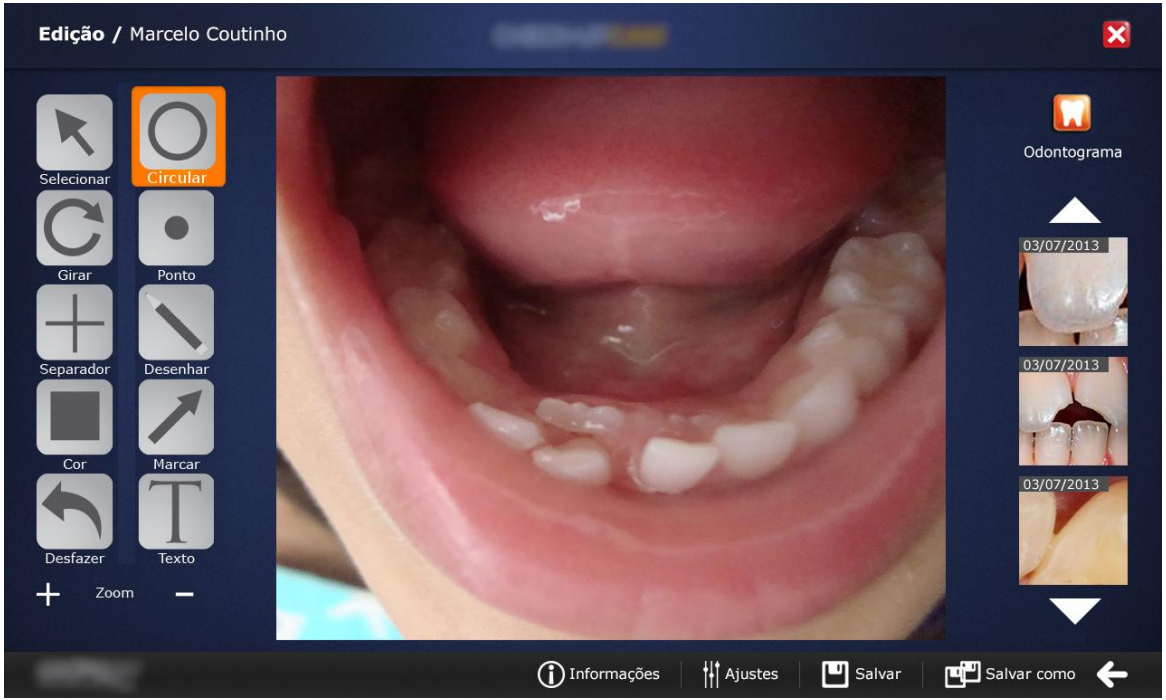
Application Layer

Storing digital dental pictures



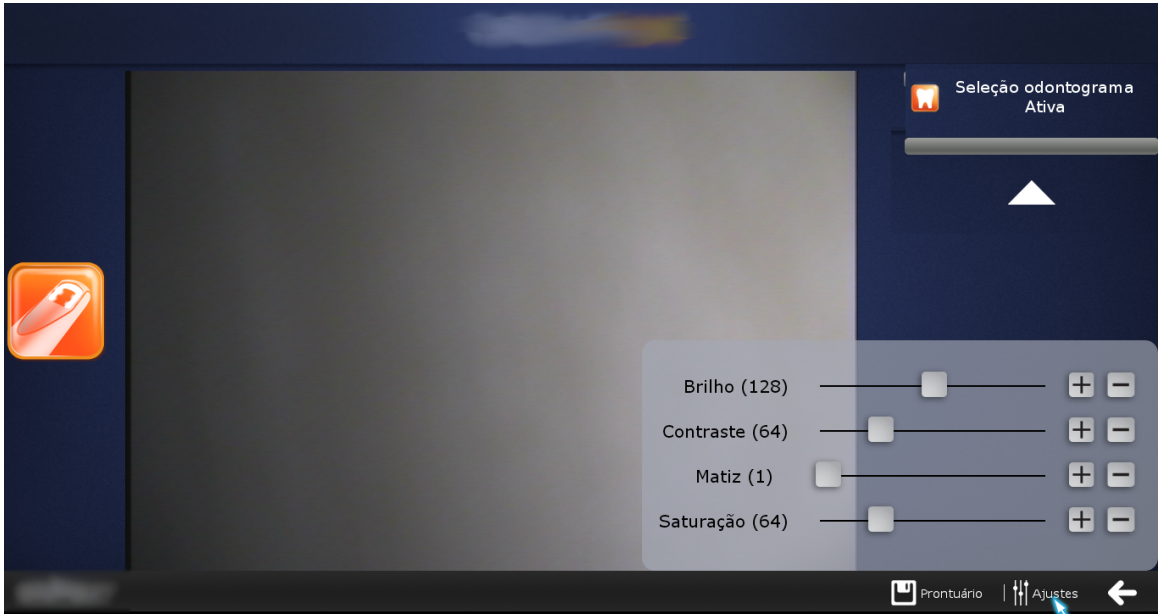
Application Layer

Image editing tool



Application Layer

Capture with camera settings



Performance Results

Action	*Previous Ubuntu Version*	*Android Version*
Boot	56s	**16s**
Save picture	6s	**< 0.02 s**
View Picture	2s	**< 0.01 s**
Start image capture	5s	**1.4s**

All done… but suddenly

- 2 new All in one devices
- New capture boards
- DVD player

Video Capture Support 3

- New devices received from the China supplier
- New Video Capture version
  - GM7113c - Generic version of SAA7113
    - Not identified by the SAA7113 driver
  - Good news there is a new SAA7113 driver supporting that board
  - Bad news is, the driver is in kernel 3.2.0.48, our is 3.0.36
  - Had to port that driver, and it's related files (v4l2 and EM28xx updates)

DVD Issue

- Kind of ignored by Android system…
  - mainly because… it is old
- But the previous product had it.
- Apparently the main issue was to mount it and done.
- Mount done, play was working but… no DVD menu access etc.

DVD Solution

- Needed a DVD application for Android (open)
- Tried VLC
  - Played ok but not menu access
- Tried XBMC
  - 1st part was to recompile XMBC for Android x86
  - Testing identified it works if DVD files were copied into a USB drive or the internal memory
  - DVD drives must not be case sensitive!!!

Finally… we identified the main problem

- Project done
- Software got a great makeup
- Operating system adapted and working
- The end?
- New delivery from china supplier, lots of devices with Atom D2500
  - Graphic card is GMA3600 - no support (driver available)

Real issue of our customer

Is not software

Is not operating system

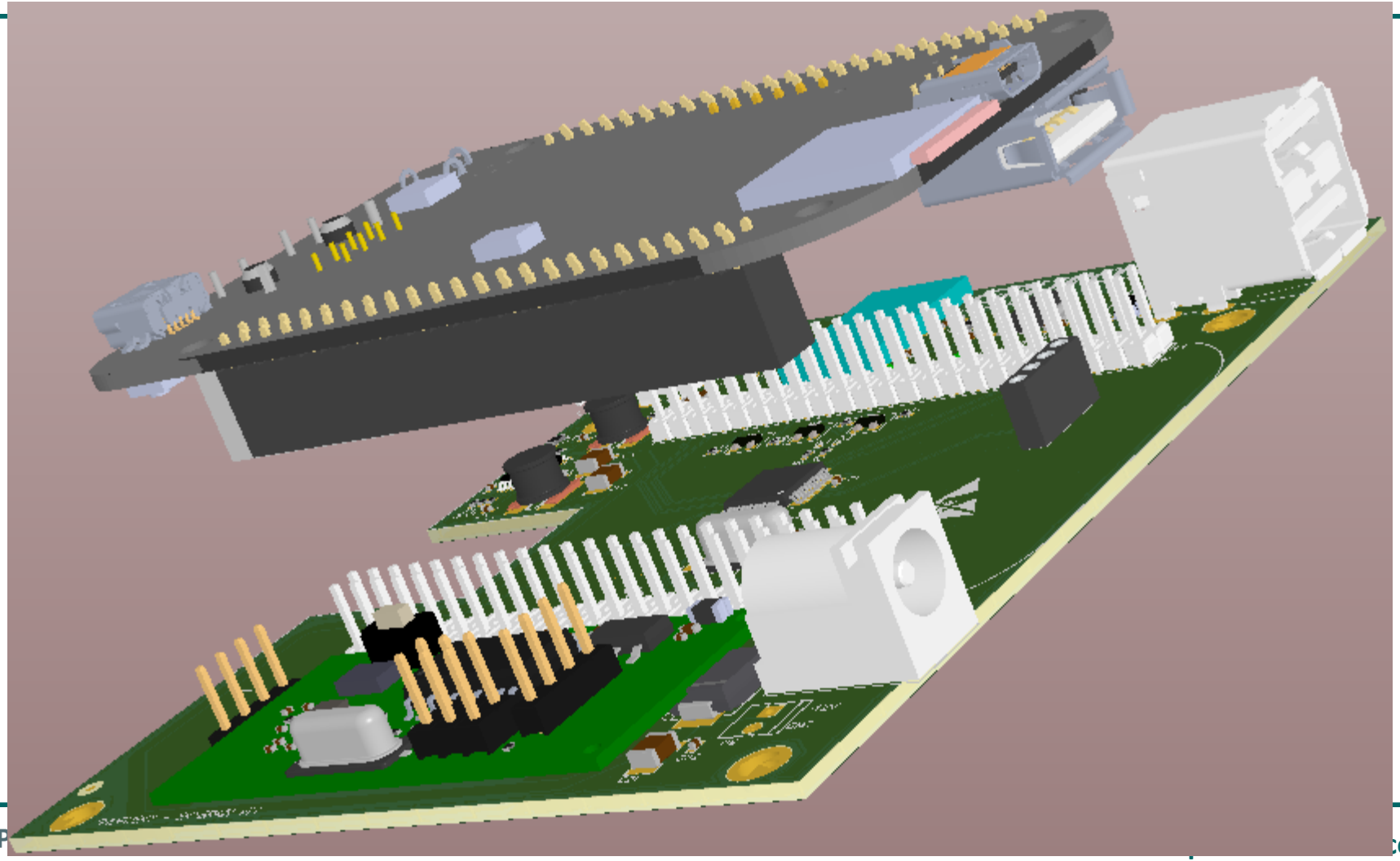
It is:

Having an embedded system with no dedicated hardware

New project

Develop a dedicated hardware

Solution uses Beagle Bone Black with a cape containing the extensions and devices needed



New project

BBB is broadly available

Mitigates the risk of having hardware changes

Android for ARM is more common

Summary

The more challenges we have, the more fun (after the stress)

Developing an embedded system without a dedicated hardware is not easy

Q&A

- Now
- Later - rafael.coutinho@phiinnovations.com

References

Android x86 - www.android-x86.org

Phi Innovations - www.phiinnovations.com